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The American Silk-worm. By L. TROUVELOT.*

THE insect fauna of North America contains several gigantic species of moths belonging to the Lepidopterous family Bombycidæ. This family has long been known to spin, when in the larval or caterpillar state, a cocoon which produces a large amount of silk, with a fibre of the most delicate texture, of great strength and of the most beautiful lustre. Every one is familiar with the beautiful and delicate fabric made from the fibres spun by that crawling repulsive creature, the silk-worm. Our country alone has eight or ten species of silk-worms: two of these, Callosamia Promethea and C. angulifera, feed on the lilac and wild cherry: they spin a small elongate cocoon of so very dense texture and so strongly gummed, that I have failed in all my attempts to reel the silk from the cocoon. These cocoons resemble very much those of Samia Cynthia, or the Ailanthus silk-worm, recently introduced into Europe from China, but the cocoon is of a looser texture. Platysamia Euryale, P. Columbia and P. Cecropia feed upon many different species of plants: they make a large cocoon, within which is another cocoon, or inner layer, of an oval form; but as the larva in spinning the cocoon leaves one end open for the exit of the moth, this prevents the reeling of a continuous thread: the silk, though quite strong, has not much brilliancy, and the worm is too delicate to be raised in large numbers. The caterpillar of Tropæa Luna, the magnificent green moth with the long tail-like expansion of the hind wings, feeds upon the oak, sycamore and other trees, and spins an oval cocoon, which, however, is so frail and thin, and the fibre so weak, that it is impossible to reel it.

Practically, however, the larva of Telea Polyphemus is the only species that deserves attention. The cocoons of Platysamia Cecropia may be rendered of some commercial value, as the silk can be carded, but the chief objection, as stated above, is the difficulty of raising the larva. The Polyphemus worm spins a strong, dense, oval cocoon, which is closed at each end, while the silk has a very strong and glossy fibre. For over six years I have been engaged in raising the Polyphemus worm, and here present the following imperfect sketch of the progress made from year to year in propagating and domesticating these insects from the wild stock.

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* Reprinted from the 'American Naturalist,' published by the Essex Institute, Salem.

BRITISH MUSEUM

In 1860, after having tested the qualities of the cocoons of the different species of American silk-worms, I endeavoured to accumulate a large number of the cocoons of the Polyphemus moth, for the future propagation of the species. At first the undertaking seemed very simple; but who will ever know the difficulties, the hardships and discouragements which I encountered! This worm having never been cultivated, of course its habits were entirely unknown, though all success in my undertaking depended very much upon that knowledge: however, I was not discouraged by the difficulties of the task. The first year I found only two caterpillars: the chance of their being each a male and female was very small, and it was another question whether the two sexes would come out of the cocoon at about the same time for the fecundation of the eggs. So success was very doubtful. Spring came, and with it one of the perfect insects: it was a male; one, two, three days elapsed, my poor male was half dead, the wings half broken, the other cocoon was not giving any signs of an early appearance: imagine my anxiety; it was a year lost. The male died on the sixth day. The other moth came out more than a fortnight after: it was a male also. During the summer of 1861 I found a dozen worms, knowing then a little about their habits. In the spring of 1862 I was fortunate enough to have a pair of these insects that came out of the cocoon at the proper time, and I obtained from their union three hundred fecundated eggs. The pair which gave me these eggs were the originators of the large number which I have cultivated since. Of these three hundred worms I lost a great many, not knowing their wants, but I succeeded in obtaining twenty cocoons in the autumn. It was only in 1865 that I became expert in cultivating them, and in that year not less than a million could be seen feeding in the open air upon bushes covered with a net: five acres of woodland were swarming with caterpillar life.

Natural History of Telea Polyphemus.—Early in summer the chrysalis of Polyphemus, which has been for eight or nine months imprisoned in its cocoon, begins to awaken from its long torpor, and signs of life are manifested by the rapid motion of its abdomen. In the latitude of Boston the earliest date at which I have seen a perfect insect is the 20th of May: from this time until the middle of July the moths continue to come out of the cocoons. The cocoon being perfectly closed, and a hard gummy, resinous substance uniting its silken fibres firmly together, it is quite hard for the insect to open it, as it has no teeth nor instrument of any kind to cut through it, and the hooked feet are far too feeble to tear such a dense structure. But the moth must have some means of exit from the cocoon: in fact, they are provided with two glands opening into the mouth, which secrete, during the last few days of the pupa state, a fluid which is a dissolvent for the gum so firmly uniting the fibres of the cocoon: this liquid is composed in great part of bombycic acid. When the insect has accomplished the work of transformation which is going on under the pupa-skin, it manifests a great activity, and soon the chrysalis-covering bursts open longitudinally upon the thorax; the head and legs are soon disengaged, and the acid fluid flows from its mouth, wetting the inside of the cocoon. The process of exclusion from the cocoon lasts for as much as half an hour. The insect seems to be instinctively aware that some time is required to dissolve the gum, as it does not make any attempt to open the fibres, and seems to wait with patience this event. When the liquid has fully penetrated the cocoon the pupa contracts its body, and pressing the hinder end, which is furnished with little hooks, against the inside of the cocoon, forcibly extends its body; at the same time the head pushes hard upon the fibres, and a little swelling is observed on the outside. These contractions and extensions of the body are repeated many times, and more fluid is added to soften the gum, until under these efforts the cocoon swells, and finally the fibres separate, and out comes the head of the moth. In an instant the legs are thrust out, and then the whole body appears; not a fibre has been broken, they have only been separated. To observe these phenomena I had cut open with a razor a small portion of a cocoon in which was a living chrysalis nearly ready to transform. The opening made was covered with a piece of mica, of the same shape as the aperture, and fixed to the cocoon with mastic so as to make it solid and air-tight: through the transparent mica I could see the movements of the chrysalis perfectly well.

When the insect is out of the cocoon it immediately seeks for a suitable place to attach its claws, so that the wings may hang down, and by their own weight aid the action of the fluids in developing and unfolding the very short and small pad-like wings. Every part of the insect on leaving the cocoon is perfect, and with the form and size of maturity, except the pad-like wings and swollen and elongated abdomen, which still gives the insect a worm-like appearance: the abdomen contains the fluids which flow to the wings. When the still immature moth has found a suitable place it remains quiet for a few minutes, and then the wings are seen to grow very rapidly by the afflux of the fluids from the abdomen. In about twenty minutes the wings attain their full size, but they are still like a piece of wet cloth, without consistency and firmness, and as yet entirely unfit for flight, but after one or two hours they become sufficiently stiff, assuming the beautiful form characteristic of the species. If, while the wings are growing, they are prevented from spreading by some agency they will be deformed for ever. Sometimes when the wings are developing the afflux of liquid is so great that some parts of the wing swell up considerably, and if one of these swellings be opened with a pin and the sac emptied a singular phenomenon will result; the wing which has lost so much of its fluids will be smaller than the others, and sometimes it will retain the normal form of the wing, only being smaller, while the wound can be detected only on very close observation. I have in my cabinet a perfect specimen of such an insect: naturalists would regard it as a monstrosity. The moth remains quiet all day, and sometimes all night and the following day, if the night be cold; but if it be warm and pleasant, at dusk or about eight o'clock, a trembling of the wings is observed for a few minutes, and then it takes its flight, making three or four circles in the air. The male flies only a few minutes, and then rests for two or three hours in the same place, not making any motion. It is worthy of notice that the place of rest is always the extremity of an oak-leaf. Why he remains there so long I could not ascertain. The female continues to fly about the bushes, and though a virgin she lays eggs, which are, however, of no use for the propagation of the species: she continues so doing for two or three hours, and then rests all night attached to some plant, probably waiting for her mate, who during this time has either remained motionless or has been feeding on the sweet exudation of the oak-leaf. Soon after the female moth has laid these useless eggs the males become very active, and fly in search of their partners, whom they soon discover, especially if there be a slight breeze and the air loaded with vapours.

The moth lays her eggs on the under side of the leaves, sometimes on a twig: generally but a single egg is deposited at one place, rarely are two or three found together. I have observed that eggs are sometimes laid upon plants which the young larvæ refuse to eat, and in several instances where there was no other plant within a long distance, and consequently the young worms died: thus it seems that instinct, like reason, sometimes commits blunders, and is not so infallible a guide as has been supposed. The incubation of the eggs lasts ten or twelve days, according to the temperature. The young worm eats its way through the shell of the egg; sometimes the young larva comes out of the egg tail foremost, as the hole in the shell is large enough to allow of the exit of the tail, but is not large enough for the head to pass through, so the worm is condemned to die in the egg. As soon as it is fairly hatched out the larva continues for some time eating the egg-shell, and then crawls upon a leaf, going to the end of it, where it rests for two or three hours, after which it begins to eat. The hatching out takes place early in the morning, from five till ten o'clock; rarely after that time.

The Polyphemus worm, like all other silk-worms, changes its skin five times during its larval life. The moulting takes place at regular periods, which come round about every ten days for the first four moultings, while about twenty days elapse between the fourth and fifth moulting. The worm ceases to eat for a day before moulting, and spins some silk on the vein of the under surface of a leaf; it then secures the hooks of its hind legs in the texture it has thus spun, and there remains motionless; soon after, through the transparency of the skin of the neck, can be seen a second head, larger than the first, belonging to the larva within. The moulting generally takes place after four o'clock in the afternoon; a little before this time the worm holds its body erect, grasping the leaf with the two pairs of hind legs only; the skin is wrinkled and detached from the body by a fluid which circulates between it and the worm; two longitudinal white bands are seen on each side, produced by a portion of the lining of the spiracles, which at this moment have been partly detached; meanwhile the contractions of the worm are very energetic, and by it the skin is pulled off and pushed towards the posterior part; the skin thus becomes so extended that it soon tears, first under the neck, and then from the head. When this is accomplished the most difficult operation is over, and now the process of moulting goes on very rapidly. By repeated contractions the skin is folded towards the tail, like a glove when taken off, and the lining of the spiracles comes out in long white filaments. When about one half of the body appears, the shell still remains like a cap, enclosing the jaws; then the worm, as if reminded of this loose skull-cap, removes it by rubbing it on a leaf; this done, the worm finally crawls out of its skin, which is attached to the fastening made for the purpose. Once out of its old skin the worm makes a careful review of the operation, with its head feeling the aperture of every spiracle, as well as the tail, probably for the purpose of removing any broken fragment of skin which might have remained in these delicate organs. Not only is the outer skin cast off, but also the lining of the air-tubes and intestines, together with all the chewing organs and other appendages of the head. After the moulting the size of the larva is considerably increased; the head is large, compared with the body, but eight or ten days later it will look small, as the body will have increased very much in size. This is a certain indication that the worm is about to moult. Every ten days the same operation is repeated; from the fourth moulting to the time of beginning the cocoon the period is about sixteen days. The worms seem entirely unable to discern objects with their simple eyes, but they can distinguish light from darkness, as a very simple experiment will show. If a worm be put in a box with two holes in it, one of them turned to the light, the other to the dark, the caterpillar will very soon come out through the hole turned to the light.

It is astonishing how rapidly the larva grows, and one who has no experience in the matter could hardly believe what an amount of food is devoured by these little creatures. One experiment which I made can give some idea of it: when the young silk-worm hatches out it weighs one-twentieth of a grain; when

10 days old it weighs	½	a grain,	or	10	times the original weight.
20	,,	3	grains,	,,	60	,,
30	,,	31	,,	,,	620	,,
40	,,	90	,,	,,	1800	,,
56	,,	207	,,	,,	4140	,,

When a worm is thirty days old it will have consumed about ninety grains of food; but when fifty-six days old it is fully grown and has consumed not less than one hundred and twenty oak-leaves, weighing three-fourths of a pound; besides this it has drank not less than one-half an ounce of water. So the food taken by a single silk-worm in fifty-six days equals in weight eighty-six thousand times the primitive weight of the worm. Of this about one-fourth of a pound becomes excrementitious matter; two hundred and seven grains are assimilated and over five ounces have evaporated. What a destruction of leaves this single species of insect could make if only a one-hundredth part of the eggs laid came to maturity! A few years would be sufficient for the propagation of a number large enough to devour all the leaves of our forests. When fully grown the worm, which has been devouring the leaves so voraciously, becomes restless and crawls about the branches in search of a suitable place to build up its cocoon; before this it is motionless for some time, holding on to the twig with its front legs, while the two hind pair are detached; in this position it remains for some time, evacuating the contents of the alimentary canal, until finally a gelatinous, transparent, very caustic fluid, looking like albumen, or the white of an egg, is ejected: this is a preparation for the long catalepsy that the worm is about to fall into. It now feels with its head in all directions to discover any leaves to which to attach the fibres that are to give form to the cocoon. If it finds the place suitable it begins to wind a layer of silk around a twig; then a fibre is attached to a leaf near by, and by many times doubling this fibre, and making it shorter every time, the leaf is made to approach the twig at the distance necessary to build the cocoon: two or three leaves are disposed like this one, and then fibres are spread between them in all directions, and soon the ovoid form of the cocoon distinctly appears. This seems to be the most difficult feat for the worm to accomplish, as after this the work is simply mechanical, the cocoon being made of regular layers of silk united by a gummy substance. The silk is distributed in zigzag lines of about one-eighth of an inch long. When the cocoon is made the worm will have moved his head to and fro, in order to distribute the silk, about two hundred and fifty-four thousand times.

After about half a day's work the cocoon is so far completed that the worm can hardly be distinguished through the fine texture of the wall: then a gummy resinous substance, sometimes of a light brown colour, is spread over all the inside of the cocoon. The larva continues to work for four or five days, hardly taking a few minutes of rest, and finally another coating is spun in the interior, when the cocoon is all finished and completely air-tight. The fibre diminishes in thickness as the completion of the cocoon advances, so that the last internal coating is not half so thick and so strong as the outside ones. During the process of spinning, the worm contracts and diminishes in size as the silk reservoirs empty. Six or eight days after the beginning of the cocoon the worm casts its last larva-skin, and then appears under a very different form—a transitory one, which is neither worm nor moth: it is the chrysalis or pupa. When the chrysalis comes out of the larva-skin, if observed closely, it will be seen that its resemblance to the perfect insect is striking; the antennæ, the head, the legs and abdomen resemble very much those of the moth. The wings only are very small, but in a few minutes they grow to about half the size of the abdomen. The legs of the chrysalis, at least the tarsi, are enclosed in the articulated leg of the larva, the wings are folded under the skin of the second and third segments, and the antennæ are rolled up in the lobes of the cranium. When the chrysalis comes out every part is detached and free, and if then put in alcohol they will remain so; but when left to its natural course it will soon be observed that a general envelope covers the whole chrysalis, and that any motion of the legs, wings and antennæ is impossible, since the insect is contained in the hard brownish envelope secreted by its tegument, and now resembles an Egyptian mummy. If before the shell of the pupa has become hard an antenna, a leg or a wing be changed from the position that the insect has given to it, that part of the body which would otherwise have been covered by the part removed out of place will remain of a different colour and of a thinner consistence, and an insect thus treated will not generally live to arrive at the imago state.

Before the last transformation is accomplished the insect takes a long rest, and this period is the longest of its life—if it can be called an existence to live without eating, breathing, or even, probably, without having any distinct sensation. The pupa spends about nine months in this torpor, and braves the hardships of winter, notwithstanding all the changes of temperature, being frozen as hard as a stone. It is only when the warm spring days come that life awakens, and the pupa is transformed into a perfect insect. If a worm be opened longitudinally, even when half-grown, there will be found in the female a vast number of little globular white bodies attached to a fine tube on each side of the stomach. These little bodies are the eggs of the future female moth, as yet in a rudimentary state. This is the only method of distinguishing the female from the male while in the larva-state. I have never been able to find any other character by which to distinguish the sexes. Again, on making the same dissection of the larva, there will be found on each side of the stomach, and running from head to tail, two long secretory reservoirs, making a great many convolutions: these are the silk-reservoirs: the transparent liquid they contain is the silk, as yet in a liquid state. If one of these vessels be taken out carefully and stretched, it will measure twenty-five inches in length: these two reservoirs become very narrow as they approach the mouth, and unite together, terminating in a special contractile organ attached beneath the mouth. When spinning, the silk is thrown out from the two reservoirs at the same time, and the thread is in reality composed of two distinct fibres which can be easily separated. The silk in the reservoirs is sometimes used in commerce, being sold under the name of "gut." The process of obtaining the gut is very simple: it consists in preparing worms ready to spin by putting them in strong vinegar for eighteen hours; a transverse opening is then carefully made on the under side and about the middle of the body, taking care not to injure the silk-reservoirs, which are very distinct. The glands, or reservoirs, are then taken out and stretched parallel to each other on a board, and dried in the shade for several days.

The Enemies of the Silk-worm.—Birds are the most formidable foes to the silk-worm, especially the thrushes, cat-birds and orioles. It is probable that ninety-five out of a hundred worms become the prey of these feathered insect-hunters. Toads and snakes also destroy some, and mice, rats, moles and squirrels eat the chrysalis enclosed within the cocoon. Among insects they have many enemies, such as various spiders, ants, bugs and wasps; but their most dangerous foe is the Ichneumon fly. A Tachina-like fly also deposits its eggs in the body of the larva. The Ichneumon flies can be seen in summer flying about bushes in search of caterpillars in which to deposit their eggs; and I have observed them often flying for an hour among shrubs where no worms were feeding, for which they searched carefully, peering under almost every leaf. When an Ichneumon detects the presence of a worm she flies around it for a few seconds, and then rests upon the leaf near her victim: moving her antennæ very rapidly above the body of the worm, but not touching it, and bending her abdomen under the breast, she seizes her ovipositor with the front legs, and waits for a favourable moment, when she quickly deposits a little oval white egg upon the skin of the larva: she remains quiet for some time and then deposits another egg upon the larva, which only helplessly jerks its body every time an egg is laid on it: she thus lays some eight or ten eggs, which adhere so firmly to the skin that it is very difficult to take them off. After several days these eggs hatch out, and the small white larvæ may be seen at work as soon as they are out of the eggs, digging their way under the skin of the worm, on whose fatty portions they feed. The caterpillar, however, continues to eat and grow, and lives long enough to make its cocoon; but when once enclosed in it the parasites which prey upon it have already eaten the fatty portions, and now attack the vital parts of the larva, which they speedily consume, and finally the one that outlives the others makes a cocoon within that of the Polyphemus larva; but it is a remarkable fact that here the maternal instinct of the Ichneumon fly makes a terrible mistake: several of the Ichneumon larvæ have entered the worm, but only one of them can find food enough to enable it to arrive at maturity; so probably the strongest one devours its weaker brethren when food becomes scarce, or else they die from hunger.

Description of the Larva of Polyphemus.—When fully grown this larva measures over three inches in length, and the body is very thick. The head is of a light chestnut-brown colour; the body of a handsome transparent light yellowish green, with seven oblique lines, of a pale yellowish colour, on each side of the body; the segments are each adorned with six tubercles, giving rise to a few hairs, which are tinted sometimes with orange, with a silvery spot on the middle: there are six rows of protuberances, two on the back and two on each side, and the oblique lines run between the two rows of lateral tubercles uniting the lower one to the upper one by a yellowish line. The under side of the body is longitudinally striped with a faint yellowish band; the spiracles are of a pale orange colour, and the feet are brown. The posterior part is bordered by a purplish brown angular line similar to the letter V.

Description of the Pupa.—The pupa is much of the form and size of a robin's egg; the colour is dark chestnut-brown, with a pale greenish spot at the base of the antennæ. The form of the legs, wings and antennæ are distinctly marked, while the posterior part is furnished with a brush of minute hooks.

For a description of the moth see the 'Synopsis of Lepidoptera,' by Dr. J. G. Morris (published by the Smithsonian Institution, Washington), only observing that there are at least six varieties—the yellow, the ferruginous, the brown, the greenish, the pale cream-colour, and another variety with the black lunule on the secondaries replaced by a ferruginous spot. The male can be easily distinguished from the female by its lighter form and by its smaller abdomen, which is not so highly coloured as that of the female; but the most striking difference is in the antennæ; those of the male are pectinated, broad, and like two feathers adorning the head, while those of the female are narrow and very much smaller.

Description of the Egg.—The egg is about one-tenth of an inch in diameter, almost cylindrical, with the two ends convex. The cylindrical surface is brown, with a narrow white spot about one-half the width of the egg; the two convex parts are white. One hundred of them weigh, on the day they are laid, eight grains; but an evaporation of the fluid contents of the body takes place, and on the day the young hatch out the same number weigh only six and two-third grains:

one hundred and ten empty shells weigh one grain: about six thousand worms are equivalent in weight to one ounce.

I will now proceed to give some instructions as to the rearing of the worm: they will be easily understood, if I have been clear enough in explaining the natural history of the Polyphemus silk-worm.

Selection and Preservation of Cocoons intended for Stock.—The cocoons intended for the propagation of the species for the following year should be carefully selected. As a general rule, the female larva is larger than the male; so the cocoon of a female is also larger than the male cocoon. I estimate a cocoon to be a very good one, and the pupa within healthy, when it is heavy for its size, and resists well the pressure between the fingers, not being deformed by it. About one half of the number intended for propagation should be selected from among the largest; very probably the majority will be females: the other half should be selected, not among the largest nor the smallest, but among the intermediate ones. When properly selected they should be placed beyond the reach of rats or mice, in boxes, baskets or bags: the boxes should be stored in a cold dry room or cellar, where the temperature does not get above forty-five degrees, for if the temperature be higher they will be liable to hatch before winter. While the temperature should not go above forty-five degrees, it can descend indefinitely without injury to the pupa.

Hatching out of the Moth.—Towards the end of May, in the latitude of Boston, the temperature sometimes reaches seventy degrees. I have said above that a heat of fifty or fifty-five degrees, continued for some time, is sufficient to put in activity the causes which transform the pupa to perfect insects. So, about the middle of May, the cocoons should be taken out of the cellar and put into the hatching-room, as the time approaches when the perfect insect will appear out of its prison. Tables or shelves should be placed in the hatching-room to lay the cocoons upon: they should be spread out, and not piled one upon the other, as the insect in coming out would get to the surface with difficulty: over the tables or shelves where the cocoons are placed should be hung pieces of cloth, or net, to which the insect can easily attach its hooks for the purpose of allowing its wings to develope. The perfect insect rarely comes out before noon, and very few after five o'clock in the afternoon. One should watch the process of exclusion, in order to help the insects when they do not readily find the net, or cloth, to cling to, and also to remove those which disturb others whose wings are already expanding. The rays of the sun should not fall directly upon the cocoons, as the heat would cause a rapid evaporation, which would certainly kill the chrysalis. Towards the evening of the day on which the moths leave their cocoon, an equal number of both sexes should be placed in the same cage, and after pairing the females should be kept until they die, which will occur in four or five days after their union. The eggs, which are stuck to the cage with gum, should be scraped off with a wooden or whalebone knife, and then spread in a large pasteboard-box to dry thoroughly. A ticket, with the date stating when the eggs have been laid, should be put upon the box, so as to indicate the day the worm will probably hatch. The length of the period of incubation depends entirely on the temperature, but in June the incubation generally lasts twelve or thirteen days, while in August the period is two days shorter. Eight or ten days after the eggs have been laid they should be placed in the hatching-box, which should be made of tin, and about three inches long, two inches broad, and one and a half inch deep. In the middle a narrow longitudinal band of tin should be soldered, and bent so as to form a hook by which the box may be hung to some twig or branch. The box should be painted, and before it is dry sand should be sprinkled over it so as to make a rough surface upon which the worm can crawl with ease. The larvæ hatch out from five to ten o'clock in the morning, and the attendant should be ready at that time to place the box upon a branch which has its extremity in the water. A thousand of the little worms can feed upon a branch of moderate size for four or five days, and when it is well covered with them the box may be removed to another branch. The larvæ feed equally well upon the different species of oaks, maples, willows, poplars, elms, hazels, birches, blueberry and other plants, without affecting the quality of the silk.

Rearing of the Larva in the Open Air.—There are different ways of raising the wild silk-worms. I have for two years cultivated them in the open air. I had about five acres of woodland enclosed by a fence eight feet high: a net was stretched over the bushes, which were of six or eight years' growth: this net, supported upon posts, was intended to protect the worms from the depredations of the birds. The eggs were put upon the bushes in the little hatching-box, so that after this there seemed but very little to do; but it was not so: over so large a space it was impossible to keep the net in good order, and the birds managed to get under it; the small ones could go through the meshes, and the larger ones through some holes in the old net, so I was obliged to chase them all the day long, as when pursuing them on one side they would fly to the other and quietly feed, until I again reappeared. Thus, besides the insect enemies enumerated above, many of the caterpillars fell a prey to the birds.

Rearing Larvæ under a Shade.—This year I made a shade open on all sides, protected by a roof to keep out the hot rays of the sun, and boards were arranged so that they could be raised up from the roof to give more light when the sun was behind the clouds, and also at morning, evening and at night: this shade had a very fine net around it, so that it was impossible for the birds to get through the meshes. In this way an oak branch can be kept fresh for four or five days: a branch is placed in every two holes, so as to leave a vacant one between any two branches. When the foliage of one branch is nearly eaten up a fresh one is put into the vacant hole, and small twigs, going from the old branch to the fresh one, are placed so that the worms can cross upon it without descending upon the table. When the worms are attached, for the purpose of moulting, they should not be disturbed or taken away from the place where they are, as they could not so easily change their skin. Three times a day the excrements should be swept from the table. In warm days some water should be sprinkled with a watering-pot upon the leaves, as the worms are fond of drinking water. The worms should be handled as little as possible, and only when it is absolutely necessary. The space that remains open between the branch and the table should be filled with paper or hay, so that the larvæ may not crawl under the table, as they would be drowned in the water contained in the bottle. For cultivating silkworms upon a large scale it would be very well to select a place with a brook running through it, as the water could be made to flow under the table, in reservoirs, where the branches could always dip in fresh water: as the water put in the bottles is soon corrupted, and the branches absorb much of it, they need to be filled up several times a day. When a cocoon is well begun, the best way will be to separate from the branch the twig and leaves between which it is built, so that other worms will not disturb the larvæ working inside: this cocoon should be placed upon lines stretched for that purpose in a special room, where the sun cannot reach it: ten or twelve days after they will be completed, and may be placed in baskets, and kept as I have indicated above. Some experiments made on our silk-worm show how hardy it is, being the easiest of all the silk-worms to take care of. Chrysalids were put into a tin box, which was placed in another box containing ice and salt; the temperature soon descended to four degrees below zero. They were allowed to remain in this refrigerator for half an hour. When taken out, the chrysalids were as hard as a piece of ice; they were immediately put into a cold room. Several days after this, the temperature of the room being above the freezing point, the chrysalids gave signs of life by moving the abdomen. Some years ago, wanting to keep a cocoon in my collection, I thrust a pin through it, and it passed through the body of a living chrysalis inside of it; this was done in the month of October. Nine months after, in June of the following year, I was astonished to find a great commotion in one of the boxes of my collection; all the specimens were broken, and I found the cocoon which had been pinned in the box, detached and open at one end, and the antennæ, head and legs of the moth projecting out of it; the insect was still living and could not come out, as the pin passing through it had also transfixed the cocoon. Through this insect had been thrust, for nine months, a pin covered with verdigris, and yet had not been killed by it! Naturalists state that it is very important, when transporting cocoons in a box, to pierce the box with holes so that the air may penetrate it, as if air was needed for a chrysalis inside the cocoon. Having observed how close and air-tight the cocoon of the Polyphemus seems to be, I could not conceive that air was needed for it to breathe. Desirous of ascertaining whether my idea was correct, I took three cocoons, and at two different times I covered them carefully with a thick coating of starch, allowing the first coating to dry before putting on the second one. After this the cocoons were covered at three different times with a heavy coating of shellac varnish; thus the cocoons were made perfectly air-tight. They were kept in a cold dry room all winter. In July the moths came out perfectly healthy, the fluid they discharge through the mouth having perfectly dissolved the starch and varnish. So these insects had been nine months with no air, except the very small volume enclosed in the cocoon, and they had accomplished their transformation just as well as if the air had been allowed to come into the cocoon.

It seems to me that when once enclosed in the cocoon, the pupa is in a transitory state. The process of assimilation, at least during the cold days, seems to have ceased. In the stomach of chrysalids can be found an albuminous, greenish substance; probably it is a food which can be assimilated, or at least transformed into some of the liquids which are discharged by the perfect insect when coming out of the cocoon. If there is any elaboration of the food in the chrysalis, the process must be very slow, and surely no air is needed to accomplish it, nor any food, except what little food is in the stomach. The most striking phenomena manifested by life is the assimilation and elimination of food; but to assimilate, the animal must take food, either in the solid or gaseous form. We know that the chrysalis cannot eat; breathing is very problematical. Before changing into a chrysalis, the worm evacuates all the contents of its stomach; so, in my opinion, the chrysalis does not breathe, or, if at all, it is so very slight as to be insignificant.

There is not much possibility of being able to obtain two broods of the silk-worm in the same year in this latitude. The earliest date at which I have obtained cocoons was the 1st of August, twenty-two days after the moth hatched from the cocoon. On the 5th of September I had young larvæ, but the heat being less in this month than in July and August, the larvæ did not grow so rapidly, and the moulting did not take place so regularly. The first moulting took place on the fourteenth day, the second the twenty-third day, the third the thirty-sixth day; on the 1st of November, or fifty-six days after their birth, they had not accomplished the fourth moulting. I could not continue the experiment, as I left for Europe the 2nd of November; but they had frozen several times, and the leaves were very hard; in fact, I do not believe that the second brood would have come to maturity. I do not see that it would be of any advantage to obtain two broods, as the moths do not all come out of the cocoon at the same time, but sometimes there are two months between the first and the last; so the process of rearing can go on permanently all summer, which is equal to having two broods.

Cocoons can be retarded in hatching out by being put in a very cold room—an ice-house, for instance; in this way they can be made to hatch another year, or nearly twenty-one months after they have been in the cocoon. In fact, the time of their appearance can be put back for an indefinite period, as life is nearly suspended. Réaumur states, that, at the time he was writing, he had in his cellar pupæ which had been there for five years, which were still living. I have myself kept pupæ of Sphingidæ, of hawk-moths, for three years in my cellar. At the time I went to Europe, they were still living, but on my return I found that the rats had eaten them.

Numerical Proportion of Sexes among Spiders.

By the Rev. OCTAVIUS PICKARD-CAMBRIDGE, M.A.

THE following facts relating to the numerical proportion of the sexes among spiders may be of interest to Mr. Darwin, who will no doubt see them if inserted in the 'Zoologist.'

In an extensive group of the family Epëiridæ, comprising several genera (Gasteracantha, Acrosoma, Pycnacantha, Plectana), I have never yet seen an example of the male sex. During a continental tour in 1864-5, I inspected collections of Arachnida in the Natural History Museums of Vienna, Milan, Berlin, Frankfort and Leyden: in all of these, if I remember rightly, there were females of this group, but certainly *no males*. The British Museum, as well as the Oxford University Museum, contain large collections of this group, but I could not detect in either an example of the male sex; nor do I believe that any one of this sex has ever yet been described by arachnologists; Walckenaer alone describes seventy-nine species, but all are evidently females. Koch (die Arachniden) describes many more, but no males. Morell indeed, in a paper entitled "Ureja exotiska Epëirider" (Ofversigt. af Kongl. Vetenscaps-Akademicus Förhandlungen, 1859, p. 299), describes two males, which he includes in this group: I have not this work by me, but on a hasty perusal of the paper, last October, there seemed to me reason to doubt whether the two spiders described really belonged to the group in question: supposing, however, that they do, it is still a remarkable fact that out of a group numbering upwards of one hundred described species, males of *two* only should have been observed; and this singularity is increased when we consider that the group comprises some of the most curious of spider-forms—forms which invariably attract the attention of even the most unscientific collector. I have seldom seen a collection of tropical insects, whether sent home dry or in spirits of wine, that did not contain specimens of these anomalous-looking spiders.

In all probability the males of this group are exceedingly small compared to the females, and for this reason perhaps they have been overlooked by collectors: if I were to hazard a conjecture as to their probable appearance I should say they would look like little horny and more or less spiny *ticks*. The idea that their minuteness has caused them hitherto to escape notice is borne out by the known minuteness of the male sex in another large group of the same family. In the genus Nephila, which contains some of the giants of the spider race, the males are almost unknown, and where known they are ridiculously disproportionate in size to the females. In Nephila (Epëira) opuntiæ, one of the most numerous spiders in Egypt, and in parts of Syria and Palestine, the female measures from a half to three-quarters of an inch in length, while the male does not exceed one-tenth of an inch. This species is gregarious and very abundant, young trees of the date palm, the prickly pear and gum acacia being often in a perfect maze of web, in which thousands of the spiders live in apparent amity: with the closest search, however, I only succeeded in obtaining three adult male specimens, so difficult was it to detect them among the multitudes of yonng individuals of the other sex.

Two species of this group, figured and described by M. Vinson ('Araneides des îles de la Reunion, Maurice et Madagascar,' pp. 183—191, plates v. and vi.), Epëira inaurata and E. nigra, present an equally striking difference in the relative size of the sexes. In his observations on the latter species he says, "Rien de plus disparate que de voir la petitesse du mâle de l'Epëire noire, auprès du volume énorme de la femelle; il se promène sur elle, marche sur ses côtés, fait rapidement en se laissant glisser le long de ses longues pattes comme le long d'un cable, lorsqu'il redoute sa colère. Il se réfugie sur le milieu de son dos pour échapper à son atteinte. : . ."

In this passage we are reminded of the well-known voracity of the female spider in our common species, of the same family, Epëira diadema, in which there is also a great disproportion in the relative size of the sexes, though nothing so great as in the species to which M. Vinson refers. The remarks of this author also lead me to suppose that this extreme disproportion may be accounted for by an application of Mr. Darwin's principle of "sexual selection." Thus the smaller the male individuals the more chance they would have of escaping the ferocity of the female, by playing at hide and seek among her limbs and over her body in the mode M. Vinson describes. This "selection" would go on exercising its inevitable influence upon the size of the males until at length they became what in M. Vinson's instances they appear to be—mere parasites upon the female: the indefinite diminution of the male would only be checked by the natural requirement of a certain size for the fulfilment of the offices of impregnation.

I have observed that the sexual disproportion in Epëira diadema is not so great as in E. nigra, *Vins.*: we may account for this by the fact of the male of the former having a formidable armature of spines on its fore legs, with which it has been seen to repel the attacks of the female; but the male of E. nigra seems to be utterly defenceless, and to have nothing but its own agility to depend upon for escape.

Some species of other families of spiders also present a very striking disproportion in the relative size of the sexes, but their habits being unknown to me it is impossible to say whether or no it may be accounted for in a similar manner.

With regard to the general question of the numerical proportion of the sexes in spiders, the case seems to be about parallel with the same question as to insects: in some species there seems to be about an equal proportion; in some the males, in others females, preponderate, but until spiders are collected and studied more, by *arachnologists*, it is impossible to say how far the apparent disproportion is due to mere want of search and ignorance of forms and habits.

No doubt there is in every species of spider and insect an absolute natural numerical proportion between the sexes, and this proportion, if we could arrive at it, would perhaps form a good specific character; but it will be long before the state of entomological science will permit of any certain conclusions on the point. In other branches of Natural History, where the facts occur more under our eyes, a natural and peculiar proportion of sexes seems certainly to exist. I have observed this in respect to pheasants reared from eggs laid in the woods, but taken and placed under the common hen; the proportion of males here is invariably larger than that of females: it varies in different seasons, but on an average my own observations lead me to state it as three-fifths of the former to two-fifths of the latter.

O. P.-CAMBRIDGE.

Bloxworth, Dorset, May 4, 1868.

A large Sturgeon.—While a fisherman, named Henry Mellish, was engaged fishing in Limehouse Reach, in the Medway, at Rochester, on the 17th of April, he succeeded in capturing a very large sturgeon. On being landed it was found to measure seven feet six inches in length, and to weigh 130 lbs. Under the ancient charters of the city of Rochester sturgeons and other "royal" fish belong to the Mayor, to whom it was immediately presented, and by whom it was in turn sent to Windsor Castle by the principal water-bailiff, as a present to her Majesty. This fish is believed to be the largest sturgeon ever caught in an English river.—*Newspaper paragraph.*

NOTICES OF NEW BOOKS.

'*The Birds of Berkshire and Buckinghamshire: a Contribution to the Natural History of the two Counties.*' By ALEXANDER W. M. CLARK-KENNEDY, an Eton Boy. Post 8vo. 232 pp. text; four coloured photographic plates. Eton: Ingalton and Drake. London: Simpkin, Marshall and Co. 1868.

COUNTIES are arbitrary divisions of the kingdom for political, ecclesiastical or other purposes, and are made without any reference to physical or natural conditions: when, therefore, we enumerate and classify the living inhabitants of a county, we know that we are on very artificial, and therefore treacherous ground. Nevertheless, the thorough and exhaustive examination of each county may eventually supply us with valuable materials for a fauna of the little island on which we live. Taking certain of the larger sucklers, as the wild cattle of Chillingham, the red deer and the roebuck, we find their range defined with the same clearness, accuracy and constancy as a river is marked on our maps. It is somewhat different with birds, because they are volatile; the eagle that may soar over London once in his life is no more a bird of Middlesex, on that ground, than I am a Frenchman because I have performed the linen-draper's tour to Paris and back. Still a very considerable interest attaches to the clear definition of the boundaries within which birds, whether resident or migratory, confine themselves, and of the periods at which they appear: thus the wheatear, one of our earliest arrivals, makes its appearance simultaneously all over the kingdom; after the most minute inquiry I fail to establish any marked discrepancy of time between its advent in Cornwall, Cork, the Giant's Causeway, the Welch mountains, Midlothian and the Shetland Islands: then, again, in one locality it appears to be a bird of the sea-beach, in another an alpine climber, in a third a bird of the fallows. How different it is with a later arrival, the nightingale; it is never heard in Cornwall, Wales, Ireland or Scotland; rarely in Devonshire, a county apparently particularly adapted to its habits; nor yet in Ireland, whence it was perhaps banished by St. Patrick simultaneously with the snakes: it swarms in Kent, Sussex and Surrey, is common in the eastern counties, and permeates sparingly the midland, north-eastern and northern counties. How different, again, the cuckoo, which is a still later arrival, but is diffused at once over the kingdom, loving woods where woods are to be found, but contenting itself with mountain-wastes where the shelter of trees is not to be attained.

Other species, again, are littoral or marine, and can only be found in their natural habitats in the vicinity of the sea; and when such species occur in inland situations we know at once that their presence is accidental, and entirely independent of geographical conditions.

Still, again, there are what may be called irruptions of species from foreign parts, as that of the sand grouse and waxwing—irruptions for which neither the scarcity of food, nor the ordinary migratory impulse, nor the cares of the breeding season will offer any explanation.

Though we may advantageously study these phenomena with the utmost care, we shall find that the comital division of a little island like Britain affords few natural areas of attraction for birds. Nevertheless it has ever been a favourite occupation with our ornithologists, not only to compile county lists, but to make them the vehicles by which to convey their own personal observations on species into the studies of their fellow-labourers; and they thus become of present use, and haply, in the lapse of time, of permanent value, but this utility and value must ever depend rather on the observations which have a general significance than on their association with particular districts: an original observation in any branch of Natural History is always worthy of preservation, while the incessant repetition of familiar facts becomes as wearisome to the instructed as it is useless to the ignorant reader.

A few of the lists which I recollect at this moment may be enumerated as containing information worthy of preservation.

1519 to 1578. Household and Privy Purse Accounts of the Lestranges, of Hunstanton, published by Mr. D. Gurney, in the 'Transactions of the Royal Society of Antiquaries' for 1833, affords very positive evidence as to species of Birds inhabiting Norfolk at that early period, and has been availed of by subsequent writers on the Ornithology of Norfolk, a county peculiarly fortunate in the number and attainments of its ornithologists.

1682. An Account of Birds found in Norfolk. By Sir Thomas Browne. A work of which Mr. Stevenson observes that it affords the means of comparing, with singular accuracy, the present state of the county with its ornithological conditions about two hundred years ago.

1826. A Catalogue of the Norfolk and Suffolk Birds, with Remarks. By the Rev. R. Sheppard and the Rev. W. Whitear. This was published in the Linnean 'Transactions,' and is a most complete and laborious account of the birds observed in both counties: of the value of this list Mr. Stevenson observes that its ample details supply many interesting particulars at a time when certain species, now no longer resident, were gradually becoming scarce.

1831. Catalogue of the Birds hitherto met in the Counties of Northumberland and Durham, published in the 'Transactions of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne,' by Prideaux John Selby. Of this Catalogue it is almost impossible to speak too highly, and the accessory remarks are those of a scholar and philosopher: it is a fact worthy of record that the number of birds observed in these two northern counties exactly corresponds with that observed by Messrs. Sheppard and Whitear in the eastern counties of Norfolk and Suffolk, namely, two hundred and seventeen, or exactly two-thirds of the entire number then ascertained to inhabit or visit Britain.

1845. A Catalogue of Birds observed in South-Eastern Durham and North-Western Cleveland, by John Hogg, published in the 'Zoologist' for 1845: this paper, relating to a much less extensive district than Mr. Selby's, contains only seven species less in number: the district, as regards physical conditions, latitude, &c., is almost identical.

1845. In this year also appeared the Rev. Richard Lubbock's Fauna of Norfolk, a work which combines scrupulous accuracy with an elegant and pleasing style: it has ever been regarded as emphatically *the* authority on the birds inhabiting the Broad District of Norfolk.

1845. Notes on the Birds of the Isle of Wight, by the Rev. Charles A. Bury. This is a paper of great value, and not obnoxious to any objection on the score of vagueness and geographical circumscription: nothing can be more satisfactory than the limits of an island,—they are open to no question,—and Mr. Bury has evidently given the subject his earnest attention, resulting in one of the best local lists ever published.

1846. In this year, too, M. Julian Deby published, in the 'Zoologist,' his Birds of Belgium, a paper which, with three exceptions, relates to birds of Britain, and therefore becomes exceedingly valuable to British ornithologists, as showing the peculiar habits and characters of our birds when on a foreign soil.

1846. An Account of the Birds found in Norfolk, with Notices of some of the Rarer Species which have occurred in some of the adjoining Counties. By John Henry Gurney and William R. Fisher. This is in all respects a first-class production: if I might venture on a criticism of a paper which, immediately on its appearance, took its place at the head of our local lists of birds, I should say that it is too brief; the instructive notes which accompany the name of almost every bird lead one to regret that they are so curt: as specimens of the richness of the mine of knowledge possessed by these two ornithologists, it is impossible to avoid feeling regret that they have given us no more of the true metal. Here for the first time we have a notice of the *coucou roux* of continental writers, a bird concerning which doubts still exist, some maintaining that it is merely the ordinary cuckoo in its first dress, others maintaining that if so it should not return to us in April and May clothed in the infantile plumage of the previous year. The concluding observations at p. 1385 of the 'Zoologist' are most excellent, judiciously arranged, and highly instructive.

1848. Birds of Sutherlandshire and Ross-shire, and Birds of St. Kilda and the outer Hebrides, by Sir William M. E. Milner, Bart., published in the 'Zoologist' for 1848. It is a matter of course that a list of the birds observed in a summer tour may be very incomplete, it being an almost imperative necessity that the compiler of such a list should be resident. I therefore do not mention these as county lists, as the winter season would undoubtedly make many additions to both of them.

1849. The Birds of Oxfordshire and its Neighbourhood, by the Reverends Andrew and Henry Matthews, published in the 'Zoologist' for 1849. In this highly instructive paper the species are classified as Residents, Summer Visitors, Winter Visitors, Passing Visitors and Occasional Visitors. This paper is written with great care, and is deserving the attention of every ornithologist.

1849. An Outline of the Ornithology of Godalming, in the County of Surrey; with brief Records of the Occurrence of some of the rarer Birds. By Edward Newman. In this list, published in the same year as the one previously described, the birds are very similarly divided, namely, into Resident Natives, Migrant Natives, Winter Visitors, Passing Visitors and Occasional Visitors: the two arrangements seem to correspond very precisely. In other respects this has no merit, except as combining the observations of those very able ornithologists, Mr. Salmon, Mr. Kidd and Mr. Stafford.

The Resident Natives are	57
The Migrant Natives	32
The Winter Visitors	29
The Passing Visitors	3
The Occasional Visitors	75
Making a total of	196

By extending this local list to the boundary of the county a very slight addition might be made to the total number of species.

1849. This year also produced a Systematic Catalogue of the Birds of Sussex, by A. E. Knox, in which the birds are divided into orders and families in accordance with the quinary system: this Catalogue forms a kind of Appendix to the same author's 'Ornithological Rambles in Sussex,' a work written in a genial spirit, and one which has passed through three editions.

1856. A List of Birds of Banffshire, accompanied by Anecdotes, by Thomas Edward, collector and dealer in Natural-History specimens at Banff. An interesting list, but the writer indulges rather too freely in the romantic: this propensity has thrown some discredit on a story of the breeding of the snowy owl in Banffshire, which is given on the authority of fishermen who captured but did not preserve the old birds, and whose names and abodes are not mentioned.

1866. The Birds of Norfolk, by Henry Stevenson, stands deservedly at the head of all county lists, and has already been abundantly noticed in these pages.

1866. In the same year we had the 'Birds of Middlesex; a Contribution to the Natural History of the County,' by James Edmund Harting, a work with the merits of which all my readers are familiar.

These various and interesting works are so many models for future compilers of local lists of birds.

Mr. Clark-Kennedy's extremely pretty volume is a continuation of this series of local lists, and does the author infinite credit. It enumerates among occasional visitors several birds which, I think, had better have been omitted; but I will not enforce my own opinion on this subject without giving the author's own account of them.

Great Black Woodpecker.—"In April, 1844, a great black woodpecker was seen on several consecutive days in the Home Park, Windsor. The observer in this case was a Mr. Walter, whose word I have no reason to doubt, and moreover he gave so accurate a description of the bird as to leave no room for doubt that it was a veritable Picus martius. Improbable as it may appear to sceptical ornithologists, I feel further justified in including this species in the present Catalogue from my own personal observation. In March, 1867, while walking under some elms in Ditton Park, I saw a great black woodpecker busily engaged on one of the tallest trees within a short distance of me. I was sufficiently near to identify the bird with certainty, and had an opportunity of observing its movements for the space of half a minute, when it flew off with an undulating flight to a considerable distance, and was seen no more."—p. 178.

Black Swan.—"A few centuries ago the black swan was not supposed to exist, and doubtless many remember the old line—

> 'Rara avis in terris, nigroque similima cygno.'

Of late years, however, some half-dozen of these birds have been procured on our coasts, and I saw, a short while ago, a young one which had been killed in Suffolk. About the year 1852 a man who lives out in the woods all day, and usually sleeps under a barn or hay-stack at night, saw a large dark-coloured bird, which he supposed was a swan, flying high up in the air over some trees near the little village of Burnham. He told Mr. Gerding's gamekeeper this piece of news, and the two went together to try to get a shot at this curious bird, which they eventually did, and the bird—a veritable black swan—fell to the gun of the keeper. What became of this rare bird I was unable to ascertain, but I believe the skin was never preserved, and that, after being admired as a 'curiosity,' it was recklessly thrown away."—p. 204.

Mandarin Duck.—"This rare duck has never occurred in a wild state, so far as I am aware, in this country, but I am here enabled to include it as a rare and occasional straggler. Mr. Sharpe tells me that a very fine adult male mandarin duck, in splendid plumage, was shot by Mr. Briggs, near Cookham, in the month of May, 1866. It might have been, and doubtless was, an escaped specimen, but it was exceeding wild, and gave Briggs a chase which lasted nearly a whole day before he managed to shoot it. It is now preserved in Mrs. de Vitré's collection, at Formosa."—p. 208.

Great Auk.—"The following extract referring to the appearance of the great auk in Buckinghamshire must be accepted *cum grano salis.* It is copied *verbatim* from the third volume of Yarrell's 'British Birds,' but it is solely in deference to the high authority of that naturalist that it is reprinted in the present work:—'Mr. Bullock told

Dr. Fleming some years ago that a specimen was taken in a pond of fresh water two miles from the Thames, on the estate of Sir William Clayton, near Marlow, in Buckinghamshire! That a bird of such thoroughly oceanic habits, and with wings so rudimentary as to be useless for flight, should be found so far inland as stated, seems, if not physically impossible, at all events highly improbable. I have no doubt that the species was misnamed, and that the bird really captured was, in all probability, one of the divers—either the great northern or the blackthroated diver. I need hardly add that all endeavours to trace a 'great auk,' or to gain any further particulars respecting it, have proved utterly unsuccessful.'"—p. 213.

Such is the evidence on which four of the species rest their claim to be considered birds of Berkshire: there are other names I should like to see expunged, but I have not space to urge my objections. I ought to observe that in the numerous existing local lists of British birds, the disposition to swell the number of species at the expense of probability is only too apparent.

Without a little bit of criticism all notices of books are essentially vapid; so I will mention a feature in the work that strikes me as objectionable—I mean the inaccuracy of the index. I had occasion to refer to Savi's warbler and at once consulted the index, not doubting it would be a sure guide: there is a double reference to the species, "Warbler, Savi's," and "Savi's warbler," but neither refers to any page in which the bird is mentioned. To use the mildest term, this may be called *inconvenient*.

EDWARD NEWMAN.

'*On the Distribution of Lepidoptera in Great Britain and Ireland.*'

By HERBERT JENNER-FUST, M.A.

SEVERAL conditions seem required to make such a work as this really useful to the truth-seeker. In the *first* place, the laborious task thus voluntarily undertaken should be carefully performed; *secondly*, the work should be so arranged as to be readily accessible, and, *thirdly*, it should give an exact idea of the matter whereon it professes to treat. Now the first of these conditions is fulfilled; the author's task has been carefully and conscientiously performed; no praise of the author's industry and zeal can possibly be too great: the second condition is not so completely fulfilled; there is no index, and no work without an alphabetical index can be readily accessible: witness Westwood's

'Introduction to the Modern Classification of Insects,' and Stainton's 'Manual of British Butterflies and Moths.' Then, as to the exactness of the idea given of the 'Distribution of Lepidoptera in Great Britain,' this exactness is entirely wanting; for instance, the six species of Satyrus are denied to South Wales, simply, I presume, on the ground of there being no printed records of their capture, although to my certain knowledge, all of them are abundant, and two or three swarm to an excess scarcely known elsewhere in the United Kingdom. The three subprovinces, 17, including the counties of Cardigan, Carmarthen and Pembroke; 18, including the counties of Merioneth, Montgomery, Caernarvon, Denbigh, Flint and Anglesea, and 19, containing Lincoln only, are perhaps the richest of all in Lepidopterous insects, whereas from the absence of recorded observations, they appear the poorest: on the other hand the Metropolitan counties, in all probability the poorest, appear in these tables to be the richest—a result, of course, of the greater number of observers; thus these laborious tables give us practical evidence of the number, care and energy of the entomologists who reside in them or visit them, but have no direct bearing on their entomological productions.

It is impossible not to feel the warmest admiration for the industry and tenacity of purpose which has carried the author through his self-imposed task, but it is equally impossible to overlook the points, in which these great qualities have failed to accomplish their object. Mr. Watson's 'Cybele Britanica' has served as the author's model, but then Mr. Watson visited, either in person or by proxy, the localities he enumerates; and plants, moreover, are stationary, they remain rooted in the earth throughout the year; while Lepidoptera are notoriously evanescent: they appear for a week, or perhaps a fortnight, and then remain hidden for the rest of the year, so that, in the absence of resident observers, like Mr. Doubleday at Epping, or constant visitors, such as frequent Darenth and West Wickham, there is no mode of attaining even a superficial knowledge of the insect fauna of a county. EDWARD NEWMAN.

Ornithological Notes from North Lincolnshire.

By JOHN CORDEAUX, Esq.

(Continued from Zool. S. S. 1125).

March 13. Pied wagtails arrived in gradually increasing numbers, both on the marshes and on the higher sands, from the 13th to the 25th of March.

March 18. Have observed a very decided increase in the number of our meadow pipits, particularly in the marshes, where they are in the summer months very plentifully distributed. The greater portion of these summer residents leave the district in the autumn.

April 2. Golden plover last seen and heard.

April 3. Wheatear (female) first seen.

April 3 and 5. On the 3rd of this month I saw several hundred fieldfares on the trees in Riby Park; and on the 5th flocks of these birds in the low grounds bordering our small stream. They are evidently drawing towards the coast preparatory to the spring migration.

Hooded Crow catching and eating Frogs.—April 6. Hooded crow last seen. There is a circumstance connected with the habits of these birds which I am not aware has been remarked upon, namely, their partiality for catching and eating frogs. When the first warm flush of spring draws these Amphibians from their snug winter retreats—the hollow banks and soft muddy bottoms of our shallow drains,—and their soft purring croak is heard, as they bask and sprawl in the shallows, then is the time for the "hoodie": even the strong inducement of early-sprouting beans tempts him not to quit his favourite haunt, where he and his mate now feast right sumptuously, acting the part of the stork in the fable, as he sedately wades in the shallows. Woe to the slowly-swimming croaker that now comes within reach of his trenchant beak; sudden as thought he is grasped on the terrible shears, borne aloft to the nearest bank-top to be quickly pulled limb from limb and devoured. So engrossed are these birds in frog-catching that their usual cautious habits are abated. Many is the gray-backed forager that has fallen to my gun as he rose bewildered and surprised from the drain, and I rejoiced that there would be one plunderer less to harry the moorcock's nest on a Scottish hill side. Judging from the many crows thus employed in frog-fishing in the early spring, the havoc made in these frog-colonies must be great. The only portion that is not eaten is the spawn of the female frog. Before I was aware of this habit of the hooded crows I have often wondered where the lumps of spawn came from we so constantly at this season find on the drain-banks.

April 11. Young rooks hatched.

April 11. Chaffinches have not yet paired. I saw a large flock today perched on the larch in one of the plantations. This flock was entirely composed of females: I did not observe a single male bird, although I looked carefully amongst them.

April 9. Nest of blackbirds hatched.

April 9. Nest of thrushes hatched.

April 14. Snipe last seen.

April 14. Tree pipit seen and heard.

April 14. A flight of buzzards, five in number, passed over this village to-day: time 12.30 P. M. They came from the direction of the sea, east, and were travelling westward. When first observed by me were flying at no great height, but, being "baited" by the rooks from my trees, rose in their beautiful spiral flight, till far beyond the reach of the clamourous rooks, and then still circling as long as I could see them, but at the same time moving westward, were soon lost to sight. I did not get sufficiently near to these birds to determine the species. They seemed too dark, however, for the roughlegged buzzard, and from their manner of soaring, &c., I am inclined to think were the so-called "common" species.

April 20. Chimney swallow first seen.

April 20. Willow wren seen and heard.

April 23. Common sandpiper seen.

April 25. Yellow wagtail's first appearance.

April 27. Sand martin first seen; we invariably see the chimney swallow in this neighbourhood before the sand martin.

April 28. Whitethroat and lesser whitethroat seen and heard.

April 30. Cuckoo heard.

May 1. Whinchat first seen.

May 1. Linnets and greenfinches, still in flocks, feeding on the groundsel growing in the clover-fields in the marshes.

May 3. House martin first seen. Is generally a very late arrival in this north-eastern corner of Lincolnshire.

May 3. Sedge warbler heard.

May 5. Swift's first appearance, five seen.

May 9. Garden warbler seen and heard.

May 12. Spotted flycatcher seen.

JOHN CORDEAUX.

Great Cotes, Ulceby, Lincolnshire,
May 13, 1868.

Du Chaillu's new Troglodytes.—Some of my readers will be pleased, others disappointed, to learn that M. Du Chaillu's new ape, the Tschego bouvé of his 'Equatorial Africa,' is accepted by Dr. Slack as a genuine species distinct from Troglodytes niger. Dr. Slack has communicated the following account of it to the Academy of Natural Sciences at Philadelphia:—"Size about equal to that of the

Anthropopithecus niger. General colour black, sometimes gray in old age. Head bald, black and shining; chin of adult bearded. Ears large, much larger than those of A. Gorilla, though smaller than those of the chimpanzee. Habitat, the deep forests, and the table lands of equatorial Africa. Figure of skeleton, Duvérnoy, Arch. du Mus, vol. ix. Figure of entire animal, Du Chaillu, 'Equatorial Africa,' p. 406. A fine adult skeleton of this rare anthropoidal ape, first noticed as a distinct species by the late lamented Duvérnoy, has been for some time in the collection of the Academy, and has been regarded until lately as that of the A. niger. For a full account of the osteological difference between the two species, I must refer to Duvérnoy's most valuable and interesting paper; though, on placing the skulls of the two animals side by side, their specific differences must be apparent to the most superficial observer. A careful study of the species appears to me to clearly prove the fallacy of regarding the A. Gorilla as the type of a distinct genus, as has been done by St. Hilaire, the tschego combining in a remarkable degree the characteristics of both genera. The cranial crests, so much insisted on as generic characters of the gorilla, are to be seen, though in a less degree of development, in the tschego, while with the black face of the gorilla are associated the large ears of the chimpanzee, and, in fact, all the characteristics of the animal are intermediate between those of the two genera, The names tschego, nshego and nchéko appear, from the accounts of travellers, to have been applied indiscriminately by the natives to all species of anthropoidal apes. To this species has been ascribed the faculty of constructing a nest or shelter among the higher branches of trees, as a protection from the inclemency of the weather during the rainy season. This, according to Du Chaillu ('Equatorial Africa,' p. 407) is covered with leaves, compactly laid together, at such an angle as to readily shed the rain. The branches are fastened to the trunk of the tree with vines; the roof is generally from six to eight feet in diameter. Surely this roof-constructing power must place its builder the highest in the scale of the quadrumana. The only figure of this animal in the flesh that I have met with is to be found in Du Chaillu's work. The so-called young in the same plate, however, resembles in a most remarkable degree a daguerreotype from life of a young A. niger, which died some years ago in the Jardin des Plantes at Paris. It must therefore be received *cum grano salis*."—*Edward Newman.*

Note on the Liver of the Wild Boar.—Referring to my note of the 31st of March, respecting the idea that the age of the bear and otter can be ascertained by counting the lobes of the liver, I desire to call attention to the statement of a correspondent at Bucharest of the 'Field' newspaper, published in that paper on the 2nd instant, from which it would appear that a similar opinion is entertained respecting the liver of the wild boar by the peasants of Wallachia: this additional coincidence appears to me to be very remarkable.—*J. H. Gurney; May* 4, 1868.

Food of the Otter.—Is the otter known to feed on fresh-water mussels? Possibly Mr. Alston, who has given the readers of the 'Zoologist' so many interesting letters on British Quadrupeds, can tell us. Last February I was at Burton, near Petworth, in Sussex, and there, on the banks of a stream frequented by the otter, I found quantities of shells of fresh-water mussels (Anodon cygneus and Unio pictorum), the first-named being the most numerous. These shells were mostly in pairs still united, but in every case either one shell or both were chipped at one end, and not broken in the way in which a crow would do it. Moreover, the crow is a scarce bird in the locality, and the part of the stream where the shells were found in the greatest profusion was quite covered in with brambles and tall willows, a willow-covert bounding it on one side. Two otters were trapped on the stream last year, and fresh traces, unmistakable, were not wanting at the time I was there; further than this an otter has been trapped there since. With all this evidence I think the otter must be found "Guilty." —*W. Jeffery, jun; Ratham, Chichester, May 9th*, 1868.

Food of the Water Shrew.—I have a similar charge to make against the shrew, and on equally circumstantial evidence. I have been endeavouring to cultivate the Planorbis corneus in some ponds in the garden, and have recently found several hoards of the remains of these shells (altogether upwards of 100 in number) amongst some rock-work at the edge of the water. The thin circumference of the shell was invariably broken away, leaving the thick spiral centre. What can have done this but the water shrew? I have several times seen these little animals near the ponds. While on this subject I will mention a circumstance which occurred to me one day last winter (December 24th, 1867). My attention was called to a struggle between a water-shrew and a frog. Both were in a ditch in which there was scarcely mud enough to cover the frog, and a little water over that. The shrew was of course the attacking party, and resolute he was, biting at the frog's nose and shaking him, "as a dog would a rat," only that it had a proportionately larger antagonist to deal with. Froggy was of course in rather a sleepy state at that time of the year, and the only mode of defence which he appeared capable of was that of burying himself in the mud; but this was of little avail. The shrew showed himself in no way afraid of sand or water, diving into both after his prey. He had succeeded in dragging the frog to the edge of the ditch, but it was a slow process, and time would not permit me to stop and see it out. There is little doubt, I think, that the shrew was victorious, and probably made a hearty meal off froggy.—*Id.*

Longevity of a Caged Lark.—A highly respectable tradesman in this town, whom I know quite well, kept until lately a lark, which, to use his own phrase, "sang at my shop-door for twenty-one summers." He had it as a young bird from the nest. "H——'s lark" was a splendid songster, and was well known to almost every one in the town: it was kept in an ordinary lark's cage, looking on to a crowded thoroughfare, was fed on hemp-seed and bread, and a hard-boiled egg cut up, with sometimes a piece of meat, and had a fresh turf in the summer twice a-week. It was very tame, but pugnacious, and would fight its owner's finger, and hang on to it with its beak when he was cleaning out the cage. Whenever he entered the shop it would welcome him, fluttering its wings and twittering or singing, even in the middle of the night. This remarkable bird was found dead one morning in its cage, and the owner tells me that when skinned for stuffing there was a quantity of blood at the top of its skull, leading him to suppose that it had been frightened, and had dashed up against the top of the cage, and so killed itself.—*Henry P. Hensman; Northampton, April* 20, 1868.

Vinous-breasted Pipit near Plymouth.—On the 21st of March I killed the Anthus spinoletta (vinous-breasted pipit of Gould) on the rocks near Plymouth, which is, I believe the second recorded Devonshire specimen, the first being obtained at Torquay. —*John Gatcombe; Plymouth.*

[I suppose this to be the water pipit (*Anthus aquaticus*) of my edition of Montagu, the Anthus aquaticus of Bechstein, and the A. rupestris of Nilsson. Blasius believes it a variety of our rock pipit (*Anthus petrosus*).—*E. Newman.*]

Nesting of the Crossbill.—Before leaving Yorkshire for Scotland I wrote to the keepers at Altyre to be on the look out for the early breeding of crossbills, particularly calling attention to the fact, as I supposed, of the birds breeding as early as the end of February and the beginning of March. On my arrival here, early in March, the keepers were most positive in stating that the birds had not paired, and soon I had many opportunities of convincing myself they were correct. During March and April I had occasion to visit the forest almost daily, after Endromis versicolor and Brephos Notha and B. Parthenias, and still the birds were in flocks, uttering, while flying, their musical "chink, chink, chink!" When settled on the pine-tree tops, busily shelling the pine cones, they were mostly mute and exceedingly tame. Towards the middle of April they began separating into pairs, and at this period were much quieter in their habits. On the 21st of April the keeper sent me word he had found two nests building, having carefully watched the old birds collecting the materials: both nests were then finished. On the 27th I went over, and soon came on the first nest, which was on a tall pine, about twenty feet from the ground, and, being quite at the extremity of the branch, very difficult to take. With my binocular I saw the female bird was sitting. Having with me a gun I wished to procure the old birds, if possible, but all attempts to get the bird to leave the nest were in vain. We pelted her with sticks, and hammered the pine-trunk with heavy stones, but all to no purpose. The head keeper fetched a long rope and saw, and sent the other keeper up the tree. The branch upon which the nest was built was now violently shaken, but the poor bird still stuck to her eggs. The man was now above the nest, and within a few feet of the bird, before he could drive her off, when, I am almost ashamed to say, she fell to my gun. The nest contained four fresh eggs, scarcely distinguishable from those of the greenfinch. The nest was a loose structure, externally composed of the dead twigs of pine, inner pine-bark, with a little moss and sheep's wool; internally it was lined with fine inner pine-bark and a long hair-like lichen, which I believe is called "old man's beard." The male bird was absent for a time, but soon arrived on the scene—alas! soon to be laid alongside his mate, on a prostrate pine-log, to cool. The other nest was thirty feet or more up a pine tree, also on the extremity of a branch, but much more easily reached: it was ready for eggs. I have little doubt but that these birds are breeding in great numbers in this forest: having, however, procured a nest and the old birds for identification, I shall molest them no more.—*George Norman; Cluny Hill, Forres, N.B., May* 4, 1868.

The Cuckoo.—There is an an error in Mr. Smith's translation of Dr. Baldamus's interesting paper on this bird (Zool. S. S. 1149), which I see is not corrected in the May number. Mr. Smith calls Hypolais vulgaris the chiffchaff, Phyllopneuste rufa the rufous warbler; whereas the former is the melodious willow warbler so rare in Britain, and the latter is our chiffchaff. With regard to the general subject of the paper, I trust that Mr. Dawson Rowley will give us his views on it, for the benefit of those who may not have seen his admirable article in the 'Ibis.'—*Edward R. Alston; Paris, May* 6, 1868.

Note on the Breeding of the Bittern in Buckinghamshire.—Having just read the interesting communication of Mr. T. E. Gunn in the May number of the 'Zoologist' on the breeding of the common bittern in Norfolk, I am induced to send you the following note. As there are so very few authenticated instances of this bird remaining here to breed, it may not be uninteresting to record that a few years ago (I cannot ascertain the exact date) a pair of bitterns stayed throughout the summer at one of the large reservoirs in the vicinity of Drayton-Beauchamp, in Buckinghamshire. Among the extensive reed-beds which line the shores of this piece of water, the bitterns constructed their nest, which was composed of dry reeds, and, I believe, stalks of various water-plants. In it the female bird deposited several eggs, which were taken, together with the nest itself, by Mr. Willians, of Tring Park; and the female bird was, I regret to say, shot off the nest, and her mate forthwith left the neighbourhood for a more secluded retreat. For these particulars I am indebted to the Rev. H. Harpur Crewe; so here is another authenticated instance to be added to the small list of records of the bittern breeding in Great Britain.—*Alexander Clark-Kennedy; 4, Prince's Gardens, W., May* 5, 1868.

Early Breeding of the Common Snipe in Sussex in 1868.—Wanting a specimen of the common snipe to settle a question on the breeding plumage, I requested a friend to procure me a bird, if possible, from the nest: to my surprise he brought me a fine female bird, shot from the nest on Saturday, April 4th, in which were four eggs: on dissection the bare state of the breast showed that the bird had been sitting some days. I have the eggs now in my collection, and they are the most beautiful set I ever saw. —*Frederick Bond;* 203, *Adelaide Road, N.W. May* 8, 1868.

Occurrence of the Greenshank and Reeve at the Land's End.—The greenshank may be regarded as a scarce bird at all times of the year on our estuaries and marshes: they mostly appear with us in the spring months, where they show a transition state of plumage from the winter to the summer garb: the specimen I saw which was killed the last week in April near the Land's End, showed this change of plumage in some of the dorsal feathers having assumed the black centre, whilst the rest of the plumage retained the hair-brown tone peculiar to winter. The interest which the elegance of form of all the Totani affords, is in this species enhanced by the intermediate link it exhibits between the sandpipers and the godwits, in the upturned tendency of the shape of the bill, which in all the true sandpipers is cylindrical, passing through this species to the godwits and from thence in the fully-developed form of the avocet (*A. recurvirostra*). I have never observed the ruff and reeve in our western district, except in the autumnal migration, or perhaps occasionally when the winter months have begun: these have been apparently birds of the year. The two small reeves sent in at the same time as the greenshank appear to be adult females: one of the characters of this species, *viz.*, in the female being remarkably less than the male, is a good point (*inter alia*) for the forming of a new genus for this bird and removing it from the Tringæ, where we see the opposite character prevail, *viz.* the larger size of the female than the male.—*Edward Hearle Rodd; Penzance, May* 14, 1868.

Blue Shark (Carcharias glaucus).—An example of the blue shark, measuring six feet in length, was found dead in Chichester Harbour, on the 3rd of November, 1867. It had been left in only a few inches of water by the receding tide. I saw the skin a few days after.—*W. Jeffery, jun; Ratham, Chichester, May* 9, 1868.

Angler or Fishing Frog (Lophius piscatorius).—A specimen of this extraordinary fish was exhibited in Chichester on the 7th of March last; its length was said to be more than four feet: it was captured at the entrance of Pegham Harbour that morning. The principal spine on the back, the "fishing rod," was short, having been broken, but the enormous mouth appeared to be the principal feature of attraction. Mr. Couch mentions an example which measured four feet and a half in length, in which this organ measured fourteen inches across? The angler has been known to swallow a herring gull and attempt the same with a great northern diver; in both cases fish as well as bird perished.—*W. Jeffery, jun.*

PROCEEDINGS OF SOCIETIES.

ZOOLOGICAL SOCIETY.

March 26, 1868.—JOHN GOULD, F.R.S., V.-P., in the chair.

The minutes of the last Meeting having been read and confirmed,

The Secretary read letters received from Sir R. Alcock and M. le Père David, with reference to a new species of stag (*Elaphurus Davidianus*), which those gentlemen had been endeavouring to procure from China for the Society's Gardens.

A letter was read from the Rev. W. Hincks, of Toronto, on the subject of Cygnus Passmori, which he considered to be a species distinct from Cygnus Buccinator. A discussion followed, in which the Chairman, Prof. Newton, Mr. Blyth and Mr. Harting took part, when it appeared that the claim of Cygnus Passmori to rank as a distinct species was not sufficiently established. Mr. Hincks had pointed out as a distinguishing character the rusty colour of the head and upper portion of the neck. Mr. Harting doubted whether this would be found constant, and thought that, at all events, it could not be considered as a distinctive character, inasmuch as he had observed the same peculiarity in other species of the genus Cygnus. He attempted to account for it by supposing that it was either a vegetable or a mineral dye, acquired either by contact with roots under water or by the birds feeding in water which was impregnated by iron.

Mr. A. G. Butler read some descriptions of little-known species of Lepidoptera.

A report was read by Dr. Günther on a collection of marine fishes which he had received from St. Helena, and out of the thirty-five species which this collection contained it appeared that six were new to Science. An interesting discussion followed on the affinities of the fish, insect and bird fauna of St. Helena, in which the Secretary, Mr. Murray and Prof. Newton took part.

Dr. Günther read a second report on a collection of fresh-water fishes from Brazil and Surinam, and communicated descriptions of some new or little-known species.

The Secretary communicated some remarks on Baker's antelope, from observation of a living animal at Turin, and read a note on the subject, which had been received, together with an original sketch of the antelope, from Sir S. Baker, its discoverer. A pair of horns belonging to this species were exhibited, and compared with the horns of another allied species, when an interesting discussion followed, in which the Chairman, Mr. Blyth and others took part.

Dr. Murie read a paper on the arrest of growth in the salmon when detained in fresh water, and exhibited an example which had been hatched in the Society's

Gardens. Dr. Günther doubted whether this was really a salmon, and was inclined to refer it either to some species of lake trout, or to a hybrid between two different species of Salmo. It appeared that this fish had been hatched from Rhine ova, obtained and deposited in the Society's Gardens by Mr. Buckland, in January, 1863; nevertheless, it did not seem clearly established that the ova were really the ova of Salmo salar. Mr. Buckland made some interesting remarks on the subject, giving a history of the ova, and exhibiting a number of fish which he had reared. A lively discussion followed, in which Dr. Günther, Dr. Murie and Mr. Buckland were the principal speakers.

The Chairman exhibited four new species of birds from different parts of the world, and communicated descriptions of them. One of the most interesting was a grebe from Lake Titicaca, in Bolivia: the wings were remarkably small, so much so as to induce the belief that the bird must be incapable of flight: on this account Mr. Gould proposed to name it Podiceps micropterus.

April 23, 1868.—W. H. Flower, F.R.S., in the chair.

The minutes of the last Meeting having been read and confirmed,

The Secretary read a letter from Mr. Layard, of Cape Town, in which he described a new species of ribbon fish (*Gymnetrus*) lately captured by him.

Dr. Murie, who had carefully dissected the sea bear (*Otaria*), which died a short time since in the Society's Gardens, read an elaborate report on its anatomy, and made some interesting remarks on its habits as compared with the habits of other seals.

The Secretary read a letter from Mr. Geoffrey Nevill, with reference to some new species of Mollusca from the Seychelles and Mauritius.

The Secretary also read a communication from Mr. Spence Bate, F.R.S., illustrated by water-colour drawings, on a new genus of fresh-water prawns. It appeared that four closely allied species are known from widely separated localities: three of them had been found respectively at Formosa, Patna, and Guatemala; the locality whence the fourth had been obtained was uncertain. Mr. O. Salvin exhibited a specimen which he had procured in Guatemala, where he stated this crustacean was well known as an article of food. An interesting discussion followed on the singular distribution of this genus.

Mr. St. George Mivart read an extract from a letter which he had received from Professor Lessona, of Turin, touching the habits and affinities of Salamandrina perspicellata.

Dr. Gray made some remarks on a new species of marmoset monkey lately placed in the Society's Menagerie, and proposed to name it Mico sericeus.—*J. E. H.*

ENTOMOLOGICAL SOCIETY.

May 4, 1868.—H. T. Stainton, Esq., Vice-President, in the chair.

Donations to the Library.

The following donations were announced, and thanks voted to the donors:—'Catalogue of Scientific Papers (1800—1863), compiled and published by the Royal

Society of London,' vol. i.; presented by the Royal Society. 'Proceedings of the Royal Society,' Nos. 98—100; by the Society. 'The Journal of the Quekett Microscopical Club,' Nos. 1 and 2; by the Club. 'The Journal of the Linnean Society,' Zoology, No. 40; by the Society. 'The Journal of the Royal Agricultural Society of England,' 2nd series, vol. iv. part 1; by the Society. 'Bulletins de l'Académie Royale des Sciences, &c., de Belgique,' 2me ser., t. xxiv.; by the Academy. 'Bulletin de la Société Impériale des Naturalistes de Moscou,' 1867, No. II.; by the Society. 'Essai d'une Faune Entomologique de l'Archipel Indo-néerlandais,' par S. C. Snellen van Vollenhoven. Troisième Monographie: Famille des Pentatomides, 1re Partie; by the Author. 'On Pauropus, a New Type of Centipede;' and 'Notes on the Thysanura,' Part iii.; by the Author, Sir John Lubbock, Bart. 'On the Lepidopterous Insects of Bengal,' by Frederic Moore; by the Author. 'Remarks on the Names applied to the British Hemiptera Heteroptera,' by J. W. Douglas and John Scott; by the Authors. Newman's 'British Moths,' No. 17; by the Author. 'The Zoologist,' for May; by the Editor. 'The Entomologist's Monthly Magazine,' for May; by the Editors.

Exhibitions, &c.

Mr. W. C. Boyd exhibited a number of skins of larvæ of Lepidoptera, admirably prepared by Mr. Davis, of Waltham Cross, so as to preserve both the form and colour of the caterpillars.

Mr. Trimen exhibited a crippled specimen of Saturnia Pavonia-minor, which, owing probably to the form and smallness of the box in which it was confined, had attempted to emerge from its cocoon tail-foremost, but failing in the attempt was found fixed with its head in contiguity with the head of the pupa-skin.

Dr. Wallace, of Colchester, offered to send eggs of the Japanese oak-feeding silkworm, Bombyx Yamamai, to any Member of the Society.

Mr. Stainton drew attention to the plate illustrating a paper entitled "Histoire d'une Chenille mineuse des feuilles de vigne, extraite d'une lettre écrite de Malte à M. de Reaumur," published in the 'Memoires de l'Académie Royale des Sciences de Paris,' in 1750. The habit of the footless larva which attacked the vine in Malta and produced a small moth was so carefully described and pourtrayed by M. Godeheu de Riville, that there was no difficulty in recognizing it as congeneric with the footless larvæ of Antispila Treitschkeella and Pfeifferella, and Mr. Stainton some time since proposed the name of Antispila Rivillii, in the hope that the species would be again detected in some of the vine-growing districts of Southern Europe. To the present day, however, the moth remains unknown, and the larva is known only by the record of M. de Riville.

Mr. Hewitson communicated the following note on Tachyris Jacquinotii (see Trans. Ent. Soc. 1868, p. 99):—

"I find, from a recent visit to the Jardin des Plantes, in Paris, that the Pieris described by Lucas under the name Jacquinotii is nothing more than a highly-coloured variety of P. albina, and when Mr. Wallace went over my collection I understood that he considered it as such. It does not come, as stated by Lucas, from New Guinea, but from New Caledonia, and has not, as I suggested, any relation with the South-American P. Isandra."

Mr. M'Lachlan mentioned that the Anax mediterraneus of de Selys Longchamps, which had on a solitary occasion been captured in the Island of Sardinia, but had been rejected from the list of European dragon-flies, was observed in swarms at Turin and in other parts of Italy by Dr. Ghiliani and others, on numerous occasions, from July to September, 1867.

Mr. F. Smith exhibited a larva which he believed to be a Xantholinus, found by Mr. O. Janson whilst digging in a sand-bank at Snaresbrook: attached by their hinder extremities to the under side of this larva, on the 5th, 7th, 9th and 11th segments respectively, were four pupæ of a Hymenopterous parasite, probably a Proctotrupes.

Mr. F. Smith also exhibited a Longicorn beetle, Cerosterna gladiator, and a large Acheta, which were very destructive to forest-trees in Madras.

Dr. Cleghorn, Conservator of Forests, Madras (who was present as a visitor), said that these insects had done great damage in the young Casuarina plantations along the Madras Railway. The attacks of the beetle were principally directed to the bark of the trees; but the cricket generally bit off the leading shoots or primary branches. It appeared suddenly in September, 1867, after some showers of rain at the end of the hot season: during the night the larvæ emerged from the sand, crawled up the young trees, and nibbled off the leading shoots (as a rabbit might have done), many of which, six inches long, were found lying on the ground; hundreds of trees had to be replaced on the railway-banks in consequence of their depredations. The best way to save the trees was to employ boys to dig out the larvæ from the tortuous galleries or passages which they made in the sand to a depth of ten to fifteen inches, and large enough to admit the little finger: he had had bushels of them dug out of their burrows and destroyed. In reply to inquiries, Dr. Cleghorn stated that he had himself frequently seen the larvæ crawling up the stems, and was convinced that they were the authors of the injury, but he had never seen them in the act of cutting off the shoots.

Mr. Trimen mentioned, as a parallel case, a tree-cricket at the Cape which eats the terminal shoots of the silver-tree (*Leucodendron argenteum*), by which, however, the shoots are not wantonly bitten off, but are consumed for food.

Mr. F. Smith exhibited eight kinds of larvæ from India, all of which were described as "borers," and as causing great damage to the coffee and other trees. Three of them appeared to be Lepidopterous; one, the "red borer" of Ceylon, which attacks a tree in the middle of the stem and works its way upwards through the pith, belonged to a species of Zenzera; a second, which was a somewhat similar larva, was found in the pith of the charcoal tree (*Sponia Wightii*); the third, the "great white borer," also looked like a Zenzera, and was usually found at the root of coffee and other trees. The remaining five larvæ were Coleopterous; one was probably a Pyrochroa, and was found in the coffee tree; another, a Buprestis, found in the root of a dead coffee tree; a third, an Oryctes, found in a dead forest tree in a coffee plantation; a fourth was a Longicorn; and the fifth was the "white borer," or "coffee borer" *par excellence*, Xylotrechus quadripes of Chevrolat. Of this insect numerous specimens in all its stages were exhibited, together with the stem of a coffee tree attacked by the larvæ.

With respect to the last-mentioned insect, Mr. F. Smith drew attention to a pamphlet (Madras, 1867) entitled 'Preliminary Remarks on the Ravages of the

Borer in the year 1867,' by Colonel C. P. Taylor, of the Madras Staff Corps. The following are extracts:—

"A very prevalent opinion exists, I believe, that the borer may come to nothing, or it may exterminate our plantations entirely. I confess that when I read of the successes and failures of various kinds of cultivation, and reflect upon the good and bad seasons all over the globe, when I consider how many luxuriant coffee estates have for so many years succeeded in India, and moreover when I admit the undoubted fact that the red borer has been known for years on our estates and in Ceylon, I cannot regard the extraordinary visitation of 1867 in any light but that of a plague which has come upon us, and with due care and precaution on our part will pass away. . . . . The borer was very destructive in 1859. His ravages in 1867 are certainly more alarming, but I believe that although this insect may remain more or less on the estates, such fatal ravages are not likely to occur for many years. It is impossible to disguise the damage already done, and doubtless this becomes a most serious question, but I trust that many an estate may yet be saved to its owners. I understand that some proprietors contemplate no further outlay, but purpose taking the coming crop, whatever it may be, and then abandoning their properties. . . . . It has been advanced by some persons who take a desponding view of this calamity that the coffee estates may die out in the same manner as the vines have perished in Madeira. I think we should dismiss any idea of this kind from our minds altogether, as the cases are not analogous. The vines, it is generally admitted, perished from a disease of the trees themselves, and not from any insect. The theory that the borer only attacks weakly trees (though supported by a most eminent entomologist with regard to ligniperdous insects) is, I believe, open to question in this case. Mr. Young, the Chairman of the Carnatic Coffee Company, in writing from personal inspection, declared that 'the finest trees are its choice victims;' and I believe every planter who has seen the borer in any numbers will bear me out in the assertion that the insect is indiscriminate in its ravages. It is quite possible that men who formed a different opinion on their own estates were mistaken, and that the sickly appearance they observed was in reality the borer who had entered the year before unnoticed. . . . The trees which on passing through an estate the planter can perceive are showing signs of something wrong should, in my opinion, be taken up, and nightly bonfires be lighted with a collection of them. . . . . Some estates which have had the borer for some three or four years are nearly destroyed. If the affected trees had been burnt the first year, I believe that such estates might have been saved to a great extent. As it is, on some estates, as many as seventeen perfect beetles have been discovered in one tree, in addition to others in the pupa state. . . . . My impression is that the white borer has been in many plantations for several years, and that he goes on, maturing or expiring, according to the weather. These dry seasons have enabled him to make a great stride in his work of destruction, and the trees have become loaded with larvæ. . . . . I advise the burning of all affected trees; and as it has, I believe, been almost universally admitted in Coorg and Mysore that shade is beneficial, I should plant shade in the vacancies instead of young coffee, which rarely succeeds with old plants. . . . . The handling of trees for the removal of any eggs might be useful. . . . . Fish-oil and soot are spoken of, to stop the trees with, and chloride-of-lime water, or arsenic solution, or cyanide of potassium, to be syringed into them. Of all preventive and remedial measures as yet proposed, I consider the most valuable to be the plan of whitewashing the trees when good lime can be procured. Fires should invariably be lighted at this season, because it appears that the borer beetle escapes at night, and during this month (September). At the same time it is probable the beetle may escape during the daytime also. It has the power of boring its way out of the tree after it has changed from the pupa to the perfect beetle, notwithstanding that it may have to open a considerable aperture for the egress of its body. It is, in fact, furnished with a boring apparatus as effective in its purposes, though not of the same description, as that of the larva. This was exemplified in an experiment made by Captain Mitchell, of the Madras Museum, and myself. A portion of a coffee tree which we split up (brought from Coorg about ten days before) disclosed a beetle in a cleft of the tree, which proved afterwards to be a female. She appeared to have no inclination to escape, though she could easily have done so. She was comfortable and apparently torpid in her hole. We tied up the piece of the tree tightly, and Captain Mitchell placed it in a glass bottle with a stopper. In the morning he examined it, and found the beetle outside the wood, lively, and running up and down in a wonderfully active manner, feeling about with her antennæ as busily as possible. On examination of the piece of the tree, we found that during the night this insect had bored a large hole outwards, and had come out of the bark from the position in which we first discovered her. . . . . It is doubtful whether the beetles will fly into the fire, though they will come round it in great numbers, in which case coolies with nets or branches of trees might kill a great many. . . . . Can we introduce or encourage the breed of any animals inimical to insect life? Can the ornithologist be of any service here? Those birds which live chiefly in trees and hedges, if encouraged and protected on an estate, might prove formidable enemies to the borer. Flocks of guinea-fowls would kill a large number of insects; . . . . they are mostly attached to white ants and grubs, but this borer is a very diminutive insect considering his powers of destruction, and I have no doubt the guinea-fowl would take to him amazingly. . . . . Is it the case that, after two or more seasons of failure in the average amount of rain, the coffee trees become to a certain extent sapless, and offer an easy prey to ligniperdous insects of all kinds? I have stated before that this is open to question, but it has been asserted that such is the case, and that when the trees are luxuriant, and from constant showers in seasonable and heavy monsoons they have become in a high state of cultivation and are full of sap, the borer cannot make so much way in his depredations; he is, in fact, bothered (so to speak) by too much moisture in the wood. There are doubtless various kinds of borers, some of which have actually attacked this year the sandal-wood, whose scent it was supposed would scare the hungriest larvæ; some again have attacked dried-up and utterly sapless trunks, in whose fibrous elements not a particle of nourishment could be supposed to dwell. . . . . It is important to discover if a juicy or a sapless coffee bush is selected by the borer, and if so, by what borer. . . . I believe that the white or red borer was originally indiscriminate in his attacks, either in shade or the open. I believe that the spread of insects has greatly increased by the absence of shelter for the birds of the forest. . . . . I think that in many cases which have undoubtedly occurred, where the coffee in the open has been so fearfully injured by insects, the real cause has been that the warmth of such situations is peculiarly favourable to insect development. Millions of eggs might be hatched in such situations, which would rot in a damp or shady position with the forest overhead. Once hatched the larvæ can only attack the tree in which they are placed. It will be asked, how do I account for the little injury done by the red borer in Ceylon, although the coffee is almost all in the open? I answer, the great and almost constant dampness of the climate is inimical to the borer, and prevents his being so prolific as in warm and dry situations. . . . . This view of the case is also borne out by the fact that in cool situations in India, such as estates at high elevations, the destruction has hitherto been of little consequence; whereas the estates which have suffered most seriously are in every case, I believe, at low elevations with a high temperature. It is a question, however, if a coffee tree can be too full of sap, too moist, too juicy, or too succulent to present a favourable field for the attacks of the dreaded white borer. All I say is, I doubt it. On examination of numerous trees, I am led to believe that if the borer larvæ had the power of selecting their food, they would undoubtedly choose the tree in which there was the most nourishment. . . . . If I am correct in my argument, we at once grasp at one of the causes of the great havoc of 1867. Man has transformed many a cool and shady forest into a hot and shadeless coffee garden, and has removed the chief enemies of the borer, cold and damp. Nature, for three years withholding her ordinary showers, has assisted certainly, but may not the result be attributable to man? May he not, by a too indiscriminate felling of forest in hot exposed situations, have caused the great increase in insect development, the results of which we now so bitterly deplore? . . . . When I was clearing away jungle, four years ago, on my estate at Nemaur in the Nuggur Division of the Mysore country, the Brahmins warned me against removing the shade. 'If you cut the trees down,' they said, 'the sun will be very hot, and will bring poochies' (insects). I was under the impression that the climate of Nemaur was too damp and the rains too heavy for shade, or even partial shade, for the coffee, but I find I was mistaken, and we are now actually planting shade in parts of the estate. The elevation is about 2800 feet. It is also an interesting subject for inquiry, if the felling and dying out of any bamboos or jungle trees have driven the borer to the coffee. The theory that because in hot dry situations, unshaded from the scorching rays of the sun, the coffee tree becomes exhausted and sapless, and therefore the more liable to the attacks of the borer, who, in fact, proceeds to that portion of the estate in the first instance, and lays her eggs there in preference to the shady portions, may be the correct one, but it does not appear to me to be so. One thing is plain, *viz.* that throughout the coffee districts of South India, the trees in the open have suffered incalculably more than those in shade. At least I am satisfied that this is so as far as regards Coorg and Mysore. . . . . In Coorg there is a legend that when bamboos die insects are created in myriads and attack all trees. Now in 1867 the bamboos in Coorg have died in enormous quantities. It is believed that they do so in a cycle of sixty years. . . . . Some planters have noticed the beetles at night collect against the windows of their houses, attracted by the light inside. Now insect-traps might be so constructed with lights as to secure great numbers in different parts of an estate during the night. It has occurred to me that a simple contrivance would be a mud hut, lighted up and roofed in, with apertures all round, and the walls inside and out hung with cloth covered with some sticky tenacious substance, with which the floor also should be covered, which would disable the beetle on contact. The natives prepare a capital bird-lime, which would answer the purpose, from the juice of the banyan tree (*Ficus indica*). . . . . A still simpler contrivance would be a large basket like a common native bird-cage, or a round and more substantial trellis-work might be constructed, open at the top, in any case covered with a sticky substance and a lantern in the centre. Another plan which has occurred to me for a trap, is a square shallow trough, with a lantern in the centre, filled to about half-an-inch with liquid molasses. It is feared that pitch would not answer, as the smell would deter the beetles from approaching."

Captain Ralph Taylor, a resident and planter in Coorg (who was present as a visitor), gave his personal experiences of the "white borer," stating that he had known coffee trees of twelve years old destroyed by thousands; that the beetle emerged at all times of the year, or at any rate in August and from November to February; and that lime, and light, and other things had been tried, but no remedy had proved effectual. At the same time he was disposed to take a hopeful view, and believed that the evil was already on the decrease and would soon disappear; whilst he had last year obtained from 7 to 8 cwt. per acre from a plantation which was attacked by the "borer." He had himself known the white borer since 1863.

Dr. Cleghorn said that other trees beside the coffee were attacked by the Xylotrechus, and he thought that drought was a predisposing cause which rendered the trees either more liable to be attacked or less able to resist attack.

Mr. F. Smith remarked that Col. Taylor's opinion, that the borer larvæ would from choice select the trees in which there was most moisture or nourishment, was directly opposed to his own experience of the habits of the species of Clytus found in this country; he had never found either the larva or perfect insect in any other than dead wood, or in the decaying branches of living trees. The borer had no doubt existed in India long before the coffee-plant was cultivated, and as clearings of jungle were made it naturally resorted to the plantations so admirably suited to its requirements. If the planters abandoned their properties, the insect would have the opportunity of increasing without check and would spread over the neighbouring plantations. Mr. Smith had observed Clytus arietis in this country to be usually very abundant about the same stump or railings for four or five years in succession, when they appeared to move off to fresh quarters, the larvæ having, as he supposed, so riddled the posts that little or no wood remained to be fed upon.

Mr. Janson expressed his conviction that, as in this country, so also in India, it was decaying or unhealthy trees alone that were attacked by Clytus.

Papers read.

The following papers were read:—

"On the Duration of Life in the Honey Bee," by Mr. J. G. Desborough.

"Descriptions of Aculeate Hymenoptera from Australia," by Mr. F. Smith.

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New Parts of 'Transactions.'

Trans. Ent. Soc., third series, vol. iii. part 5, containing a further instalment of Mr. Pascoe's "Longicornia Malayana," and the first part of 'The Transactions of the Entomological Society of London for the year 1868,' were on the table.—*J. W. D.*

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Little Bittern at Braunton, North Devon.—I have been informed that, in the first week of May, a little bittern was killed at Braunton, near Barnstaple, by one of the keepers of Sir W. Williams, Bart.—*M. A. Mathew; Weston-super-Mare, May* 19, 1868.

Homelyn Ray and Gemmeous Dragonet off Plymouth.—I have just received a specimen of the Homelyn ray (*R. maculata*), the smallest I ever saw: it was a male, 6 inches long over all, 2½ inches long from the snout to the origin of the tail, which, as will be seen, was of the disproportionate length usual in young rays; across the wings from tip to tip the fish was 3½ inches: the spots were developed, but disappeared soon after death: the spines were all developed in the precise order given by Yarrell. The same trawl which took this fish took the yellow skulpin or gemmeous dragonet (*Callionymus Lyra*) and the Asterias Placenta of Pennant.—*Thomas Cornish; Penzance, May* 14, 1868.

BRITISH INSECTS.

MR. J. C. STEVENS has received instructions to Sell by Auction, at his Great Room, 38, King Street, Covent Garden, on Tuesday, June 30, at half-past Twelve precisely, THE VALUABLE COLLECTIONS OF BRITISH LEPIDOPTERA, COLEOPTERA AND INSECTS OF OTHER ORDERS, formed by the late THOMAS DESVIGNES, Esq.; also the Mahogany Cabinets in which they are contained, and the Entomological and other Books. On view the day prior and Morning of Sale, and Catalogues had one week previous to the Sale.

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